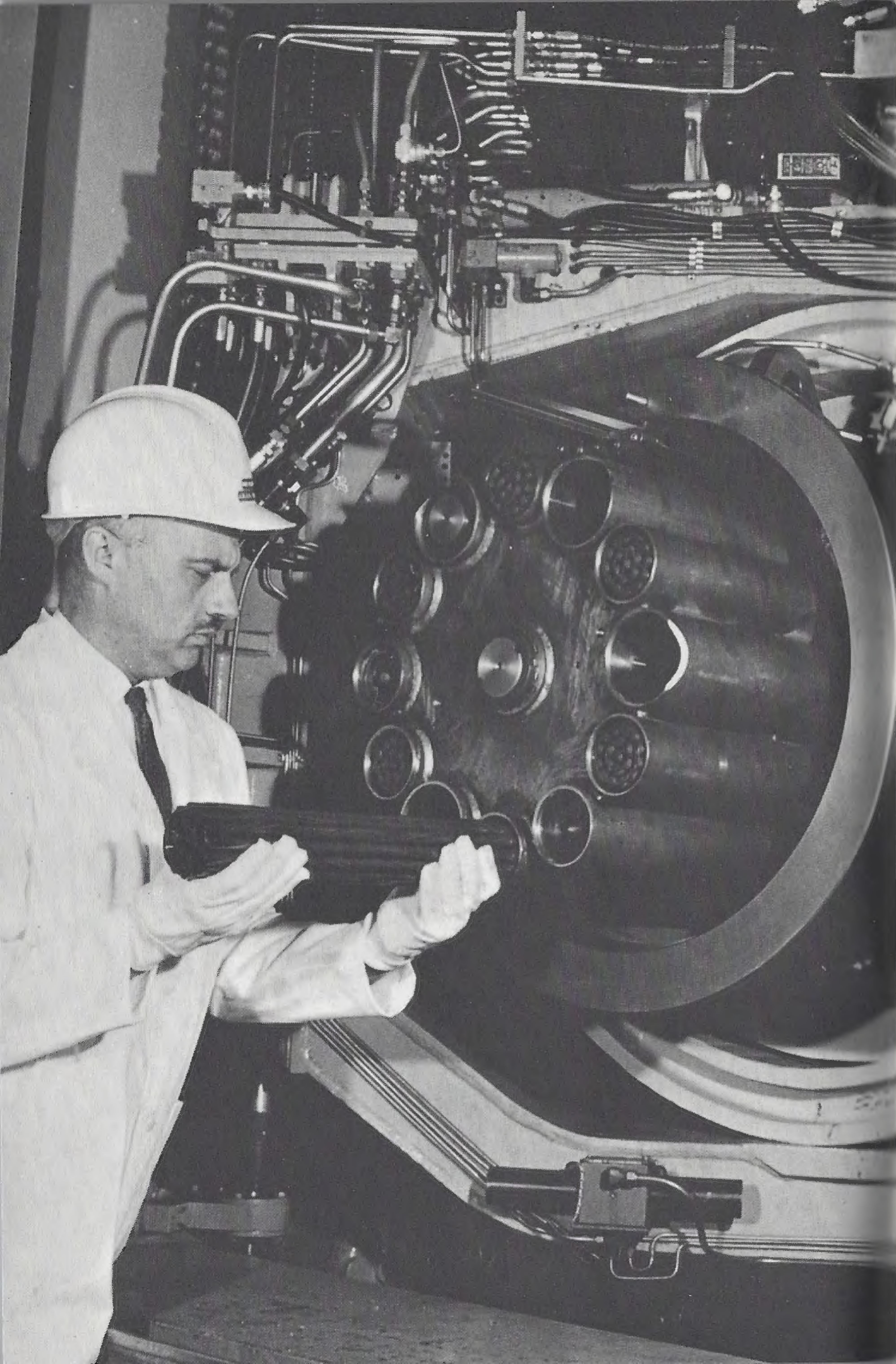




**101 ATOMIC TERMS
AND WHAT THEY MEAN**



101 ATOMIC TERMS AND WHAT THEY MEAN

Inspecting one of the two fuelling machines for Douglas Point station.

Photo: Atomic Energy of Canada

INTRODUCTION

The petroleum industry uses atomic energy in important phases of its work. Radioisotopes aid in exploration for new sources of oil and in pipeline transportation. Atomic energy is being used more broadly in research and engineering to develop oil and chemical products and processes. Neutron generators help analyze chemical compounds. In radiation laboratories, radioactive materials such as cobalt-60 assist in triggering new chemical reactions that may lead to useful materials.

This booklet is designed to help you share our interest in this exciting and promising area of science. It is adapted from an original publication of the Esso Research and Engineering Company, with terms and illustrations appropriate to Canada prepared in cooperation with Atomic Energy of Canada Limited.

Italics indicate key words defined in this glossary.

Imperial Oil Limited
May 27, 1966

"A" Symbol for *mass number*, that is, the number of *protons* plus the number of the *neutrons* in the *nucleus*. The mass number is approximately equal to the *atomic weight*. For example, "A" is 1 for hydrogen, 2 for *deuterium* and 235 for *uranium*.

ACCELERATOR A device for imparting very high velocity to *charged* particles such as *electrons* or *protons*. These fast particles can penetrate matter and are types of *radiation*. Fast particles of this type are used in research or to study the structure of the *atom* itself. Some accelerators are called atom smashers. (Turn to Page 27 for a listing of accelerators and *reactors* by type.)

ACTIVATION Making a substance artificially *radioactive* in an *accelerator* such as a *cyclotron* or by bombarding it with *neutrons* in a *reactor*.

ALPHA PARTICLE (*alpha ray, alpha radiation*). A small electrically charged particle of very high velocity thrown off by many *radioactive* materials, including *uranium* and *radium*. It is identical with the *nucleus* of a helium *atom* and is made up of two *neutrons* and two *protons*. Its electric *charge* is positive and twice as great as that of an *electron*.

ANTI-PARTICLE A particle which interacts with its counterpart of the same *mass* but opposite electric *charge* and magnetic properties, (e.g.: *proton* and anti-*proton* or *neutron* and anti-*neutron*) with complete annihilation of both and production of an equivalent amount of *radiation* energy. The *positron* and its anti-particle, the *electron*, annihilate each other upon interaction and produce *gamma rays*.

Italics indicate key words defined in this glossary.

ATOM The tiny "building block" of nature. All materials are made of atoms. The *elements*, such as iron, lead and sulphur, differ from each other because they contain different atoms. There are six sextillion (6 followed by 21 zeros) atoms in an ordinary drop of water. The word "atom" comes from the Greek word meaning indivisible. Now we know it can be broken down and consists of an inner core (*nucleus*) surrounded by *electrons* which rotate around the nucleus something like the planets around the sun.

ATOMIC ENERGY Energy released in *nuclear reactions*. Of particular interest is the energy released when an atom's *nucleus* splits into smaller pieces (*fission*) or when two nuclei are joined together at temperatures of several hundred million degrees (*fusion*). "Atomic energy" is really a popular misnomer. It is more correctly called "*nuclear energy*".

ATOMIC NUMBER The number of *protons* (positively charged particles) found in the *nucleus* of an *atom*. All *elements* have different atomic numbers. The atomic number of hydrogen is 1, that of oxygen 8, iron 26, lead 82, *uranium* 92. The atomic number is also called *charge number* and is usually denoted by Z.

ATOMIC WEIGHT The atomic weight is approximately the sum of the number of *protons* and *neutrons* found in the *nucleus* of an *atom*. This sum is also called *mass number*. The atomic weight of oxygen, for example, is approximately 16, with most oxygen atoms containing 8 neutrons plus 8 protons. Aluminum is 27, it contains 14 neutrons and 13 protons.

The 200,000 kilowatt Douglas Point nuclear power station on the shore of Lake Huron in Bruce County, Ont.



AUTORADIOGRAPHY Self-portraits showing the distribution of *radioactive* material in an object made by placing the object close to a photographic film. The *radiations* fog the film leaving an image of the distribution of the source. It was such self-portraits that led to the discovery of radioactivity.

BACKGROUND The *radiation* coming from *sources* other than the *radioactive* material to be measured. This background comes in part from naturally radioactive substances on earth and is in part due to cosmic rays which constantly bombard the earth from outer space.

BETA PARTICLE (*beta radiation*). A small electrically charged particle thrown off by many *radioactive* materials. It is identical with the *electron* and possesses the smallest negative electric *charge* found thus far in nature. Beta particles emerge from radioactive material at high speeds, sometimes close to the speed of light.

BINDING ENERGY The energy which holds the *neutrons* and *protons* of an atomic *nucleus* together.

BREEDER A *reactor* which is producing more atomic *fuel* than it is consuming. Some *nonfissionable nuclei* bombarded by *neutrons* can be transformed into a fissionable material, such as *plutonium*, which can be used as fuel. Scientists are working toward the day when all the material burned in reactors will be replaced through this process. See *converter*.

BUBBLE CHAMBER A chamber containing a liquefied gas such as liquid hydrogen, under conditions such that a *charged* particle passing through the liquid forms a trail of bubbles along its path which is thus made visible.

BURN-UP The extent to which the initial fissile material in a *fuel element* has been consumed by *fission*.

CAPTURE The process of increasing the *mass* of a *nucleus* by the absorption of another particle, e.g.: *neutron*, *alpha particle*, *electron*, etc. Frequently the resulting *isotope* is *radioactive* and most *radioisotopes* are produced from the capture of neutrons by stable isotopes in a *reactor*.

CASK (flask). A thick-walled container (usually lead) used for transporting or storing *radioactive* materials.

CESIUM-137 An *isotope* of the *element* cesium having a *mass number* of 137. One of the important *fission products* and a constituent of *fall-out*. It has a *half-life* of 30 years.

CHAIN REACTION When a *fissionable nucleus* is split by a *neutron* it releases energy and one or more neutrons. These neutrons split other fissionable nuclei releasing more energy and more neutrons making the reaction self-sustaining (as long as there are enough fissionable nuclei present).

CHARGE The electric charge of a *nucleus* is proportional to the number of *protons*. For example, the charge on *deuteron* is 1, the charge on a *uranium* nucleus is 92.

CLOUD CHAMBER A glass-domed chamber filled with vapour under conditions such that a *charged particle* passing through it leaves a track of condensation much like the vapour trail of a jet plane and showing the path of the particle. The cloud chamber and *bubble chamber* serve the same purpose.

COBALT-60 A *radioactive isotope* of the *element* cobalt. Cobalt-60 is important as one of the least expensive sources of *gamma radiation* and is used widely in research, industry and *radiotherapy*.

COMPTON EFFECT The glancing collision of a *gamma ray* with an *electron*. The gamma ray gives up part of its energy to the electron. The name is taken from the discoverer, Dr. Arthur Compton.

CONTROL ROD A rod, containing an *element* such as boron, used to control the power of a nuclear *reactor*. The control rod absorbs *neutrons* which would normally split the *fuel nuclei*. Pushing the rod into the reactor *core* reduces the release of atomic power. Pulling out the rod increases it.

CONVERTER A nuclear reactor which produces *new fuel* (*fissile material*) from *fertile material* nearly as fast as it *burns* it up. For example, a natural *uranium-heavy water reactor* consumes U-235 and produces *plutonium* from U-238. A *breeder* produces more fissile material than it consumes.

COOLANT The coolant fluid transfers the heat which is produced in the *core* of the *reactor* to the outside. In a power produc-



Installing fuel rods in a pressurized water reactor.

Photo: Babcock & Wilson Company

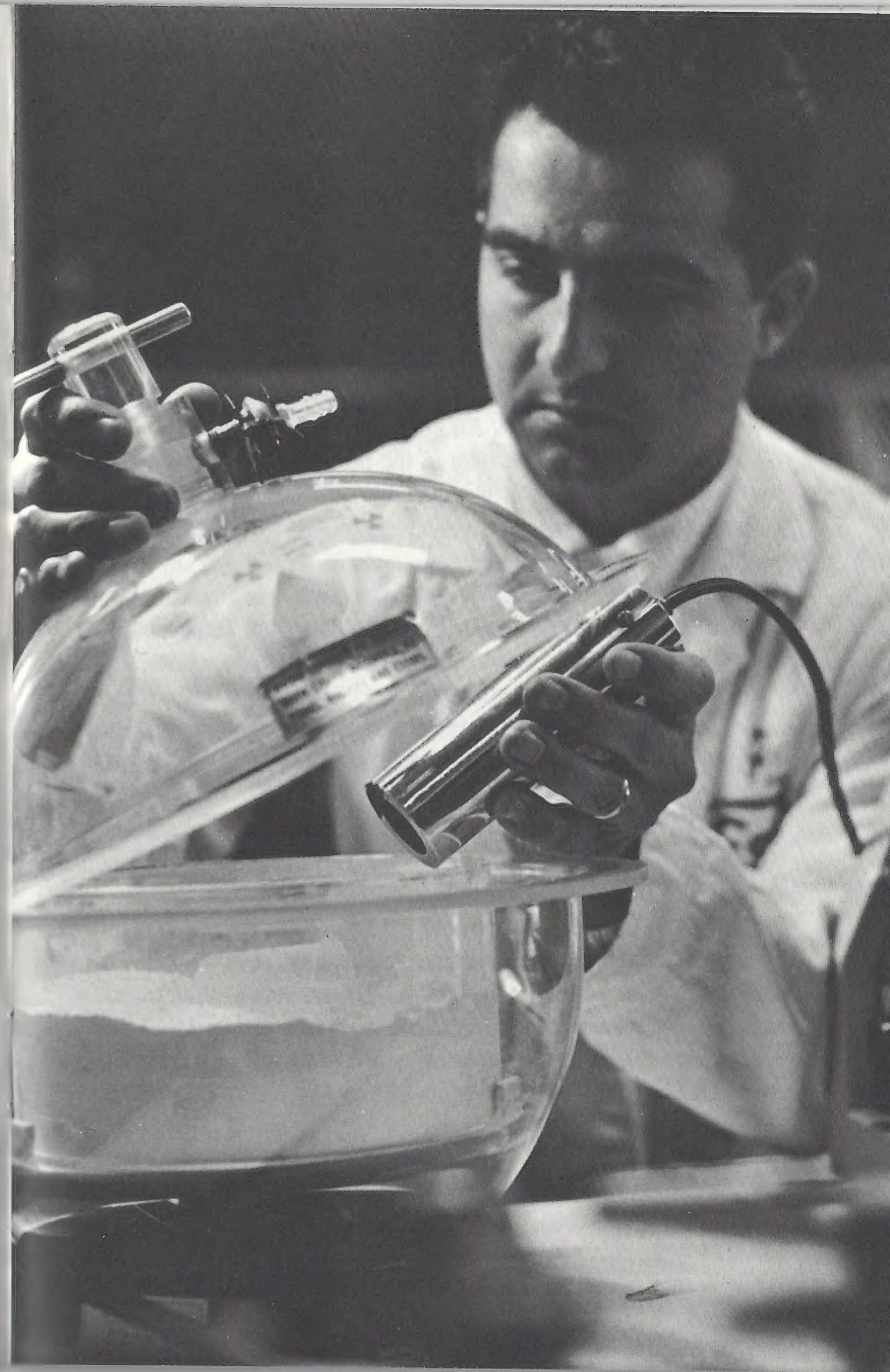
ing reactor, this heat is then utilized by standard methods to do work. The coolant may be water, steam, hydrocarbons, or gases such as helium or carbon dioxide.

CORE The heart of a nuclear *reactor* where the *nuclei* of the *fuel* split (*fission*) and release energy. The core is usually surrounded by a reflecting material, such as graphite or water, which bounces escaping *neutrons* back to the fuel. It is usually made up of *fuel elements* and a *moderator*.

COUNTER A device for detecting nuclear disintegrations to measure *radioactivity*. The signal which announces a disintegration is called a count. A Geiger counter is a gas-filled electrical device which detects the presence of an atomic particle or ray by the *ions* it produces. A scintillation counter is a device for counting atomic particles or rays by means of tiny flashes of light (scintillations) which the particles produce when they strike certain crystals or liquids.

CRITICAL MASS The amount of nuclear *fuel* necessary to sustain a *chain reaction*. If too little fuel is present too many *neutrons* will escape and the reaction cannot be sustained.

CURIE A measure of the rate at which a *radioactive* material throws off particles. The radioactivity of one gram of *radium* is a curie. It is named for Pierre and Marie Curie, pioneers in radioactivity and discoverers of the *elements* radium, radon, and polonium. One curie corresponds to 37 billion disintegrations per second.



CROSS SECTION The chance that a *nuclear reaction* will take place is measured by the reaction's cross-section. It is the area of an imaginary disc forming the target which a bombarding particle must strike to cause the reactions to take place. Cross sections are very small areas and are measured in multiples of 10^{-24} square centimetres. This unit is called the barn.

DECAY When a *radioactive atom* disintegrates it is said to decay. What remains is a different *isotope* of the same *element* or, nearly always, a different element. An atom of polonium decays to form lead, ejecting an *alpha particle* in the process. *Cobalt-60* decays by the emission of a *beta particle* and some *gamma radiation* to become Nickel 60.

DEUTERIUM AND DEUTERON Deuterium is *heavy hydrogen*. The *nucleus* of *heavy hydrogen* is a deuteron. Deuterium is called heavy hydrogen because it weighs twice as much as ordinary hydrogen. A deuteron contains one *proton* and one *neutron* whereas the hydrogen nucleus contains only one proton. Deuterons are often used for the bombardment of other nuclei.

DOSIMETER (dose meter). An instrument used to determine the *radiation* dose delivered to a specific person or area.

ELECTRON A minute atomic particle possessing the smallest amount of negative electric *charge* found thus far in nature. The electric charge of the *proton* is just as large as that of the electron but is positive. In an *atom*, electrons rotate around a small *nucleus*. The *mass* of an electron is only about a two-thousandth the mass of a proton or *neutron*.

ELECTRON VOLT (eV). A small unit of energy. An *electron* gains this much energy when it is acted upon by one volt. In nuclear science, very high energies have been used. When electrons are accelerated through a billion volts or more they attain correspondingly higher energies and travel at speeds approaching the speed of light — 186,000 miles per second. (See page 29)

ELEMENT A substance made up of *atoms* all having the same *atomic number*. Hydrogen, oxygen and *uranium* are all elements. Many elements consist of a mixture of *isotopes*, which all have the same *atomic number* and the same chemical properties but have different *mass numbers*.

ENRICHMENT The process of increasing the natural composition of the *isotopes* of an *element* to suit a particular purpose. For example, *neutron counters* frequently contain Boron in which the percentage of Boron-10 has been increased in order to improve the detection efficiency. Frequently *reactors* are charged with *uranium* in which the percentage of the *fissile* isotope Uranium-235 has been increased in order to permit the use of a less efficient *moderator* such as natural water rather than *heavy water* or graphite.

FALLOUT Dust particles which contain *radioactive fission products* resulting from a *nuclear explosion*. The wind can carry fallout particles many miles.

FERTILE A fertile material is a material which cannot itself sustain a *chain reaction* but which, by a process of *neutron capture* in a *reactor*, can be converted into a *fissile* (fissionable) *nucleus*. Thorium 232 and *uranium* 238 are fertile substances which convert to uranium 233 and plutonium 239.

FILM BADGE A piece of masked photographic film worn like a badge by nuclear workers. It is darkened by nuclear *radiation*, and radiation exposure can be checked by inspecting the film.

FISSION The division of an atomic *nucleus* into two parts accompanied by the release of a large amount of *radiation* and heat.

FISSIONABLE (Fissile). A *nucleus* which may be divided (fissioned) by the interaction of a *neutron*.

FISSION PRODUCTS The *nuclides* produced either by *fission* or by the subsequent *radioactive decay* of the *nuclides* so formed.

FUEL The *fissionable* material consumed in a nuclear *reactor*.

FUEL ELEMENT The form in which *fuel* is introduced into a *reactor*, commonly in rods, plates, or pellets.

FUSION The joining of atomic *nuclei* to form a heavier nucleus. If two nuclei of light *atoms* fuse, the fusion is accompanied by the release of a great deal of energy. The energy of the sun is believed to be derived from the fusion of hydrogen atoms to form helium.

GAMMA RAYS The most penetrating of all useful forms of *radiation* emitted by a *radioactive* substance. See *X-rays*.

HALF-LIFE A means of classifying the rate of *decay* of *radioisotopes* according to the time it takes them to lose half their strength (intensity). Half-lives range from fractions of seconds to billions of years. *Cobalt-60*, for example, has a half-life of 5.3 years. A *radioactive* material loses half its strength in a period of time equal to its half-life.

HEAVY HYDROGEN AND HEAVY WATER Heavy hydrogen is the same as *deuterium*. Heavy water is water which contains heavy hydrogen instead of ordinary hydrogen. It is used in *reactors* as a *moderator* and *coolant*.

HOT A colloquial term meaning highly *radioactive*.

ION Usually an *atom* which has lost one or more of its *electrons* and is left with a positive electrical *charge*. There are also negative ions, which have gained one or more extra electrons.

IONIZATION CHAMBER A device roughly similar to a Geiger *counter* and used to measure *radioactivity*.

ISOTOPE A member of a family of *nuclides* each having the same *atomic number* as the others but each having its own *mass number*. In nature, most of the *elements* are made up of several isotopes. Many more isotopes have been made artificially. Those that are *radioactive* are often called *radioisotopes*.

MANIPULATORS Mechanical hands or tongs used to handle *hot* materials. They are remotely controlled from behind a protective *shield*.

MASS NUMBER The number of *neutrons* plus the number of *protons* in a *nucleus*. Its symbol is *A*.

MESON A particle which weighs more than the *electron* but generally less than the *proton*. Mesons can be produced artificially. They are also produced by cosmic *radiation* (natural radiation coming from outer space).

MODERATOR A material used to slow down *neutrons* in a *reactor*. These slow neutrons are particularly effective in causing *fission*. Neutrons are slowed down when they collide with *nuclei* of light *elements* such as hydrogen, *deuterium* and carbon, three common moderators.

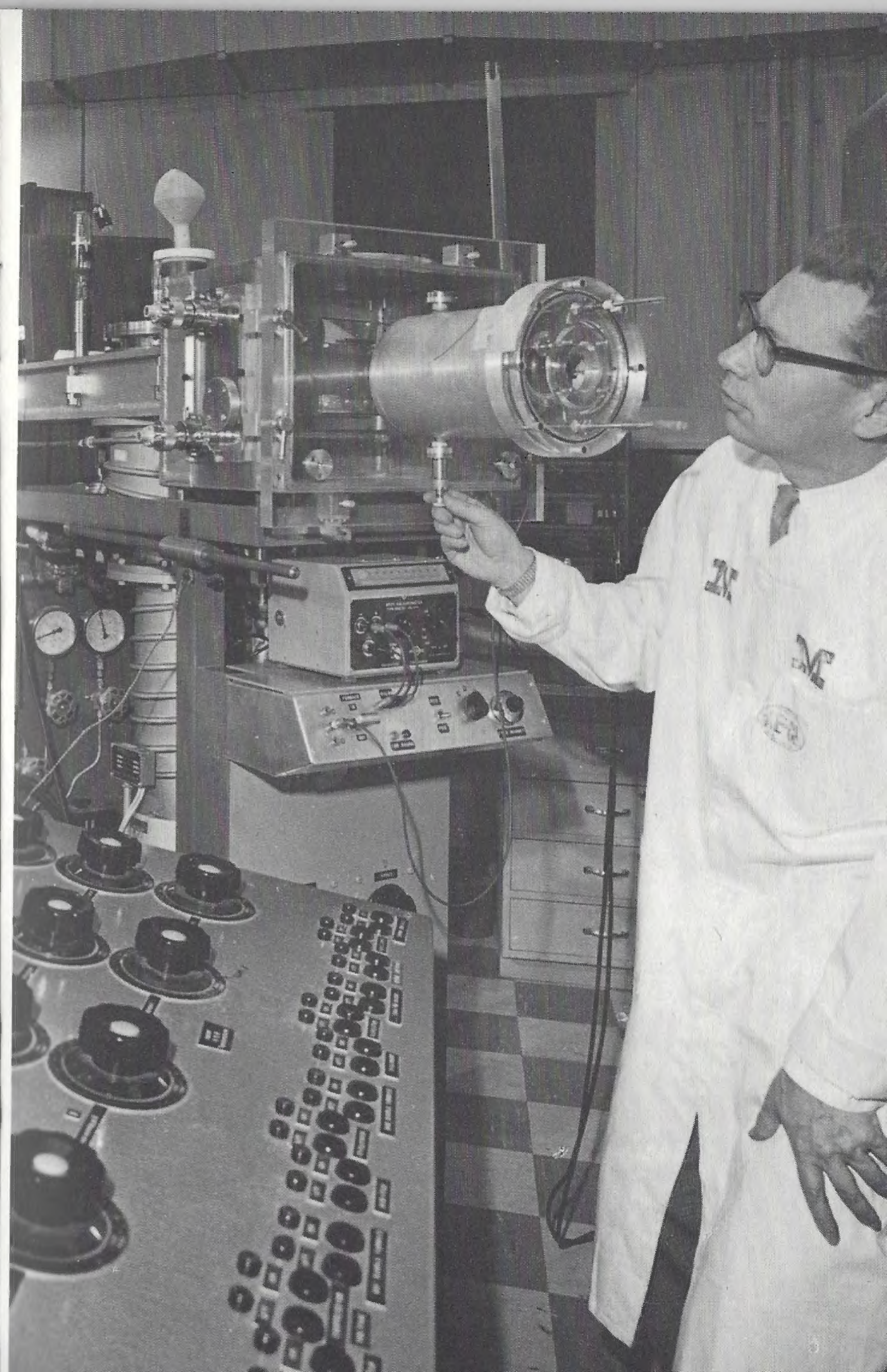
MONITOR A *radiation* detector used to determine whether an area is safe for workers.

MWd Megawatt days, usually per ton. The amount of energy obtained from one million watts of power in one day. This unit is used normally to indicate the total energy produced in a *reactor* in a period of time. One megawatt day per ton is the amount of energy expressed in megawatt days, produced from one ton of *nuclear fuel*. It indicates the extent of *burn-up* of nuclear fuel. 10,000 MWd per ton is about one per cent burn-up.

NEUTRINO A particle resulting from *nuclear reactions* which carries energy away from the system but has no *mass* or *charge*, and can pass freely through matter.

NEUTRON One of the three basic atomic particles. The neutron weighs about the same as the *proton* and, as its name implies, has no electric *charge*. The free neutron is unstable, having a *half-life* of about 12 minutes, and *decays* to a proton.

NUCLEAR ENERGY The energy released in a *nuclear reaction*, such as *fission* or *fusion*. Nuclear energy is popularly, though mistakenly, called *atomic energy*.



The electromagnetic isotope separator at the Chalk River nuclear laboratories.



NUCLEAR EXPLOSION The rapid *fissioning* of a large amount of *fissionable* material. It creates an intense heat and light flash, a heavy blast, and a large amount of *radioactive fission products*. These may be attached to dust and debris forming *fallout*. Nuclear explosions also result from nuclear *fusion*, which does not give radioactive fission products.

NUCLEAR REACTION Result of the bombardment of a *nucleus* with sub-atomic particles or very high energy *radiation*. Possible reactions are emission of a particle different from the bombarding particle or the splitting of the nucleus (*fission*). The *decay* of a *radioactive* material is called a nuclear reaction. *Fusion* is also a nuclear reaction.

NUCLEONICS The application of nuclear science and techniques in physics, chemistry, astronomy, biology, industry and other fields.

NUCLEUS The inner *core* of the *atom*. It consists of *neutrons* and *protons* tightly locked together.

NUCLIDE An individual atomic species uniquely described by the number of *protons* and the number of *neutrons* contained in the *nucleus*.

PHOTON A bundle (quantum) of *radiation*. *X-rays*, *gamma rays* and light all consist of photons.

PITCHBLEND An ore containing both *uranium* and *radium*. The *Curies* had to purify tons of *pitchblende* to obtain a barely visible speck of radium.

Using remote manipulators to load a container with radioactive Cobalt-60.

PLUTONIUM A heavy *element* which undergoes *fission* under the impact of *neutrons*. It is a useful *fuel* in nuclear *reactors*. Plutonium, found in nature only in trace quantities, can be produced and "burned" in reactors.

POISON A material introduced into the *reactor core* to absorb *neutrons*. The *element* boron is a popular poison, and is used in *control rods*.

POSITRON A particle which has the same weight and *charge* as an *electron* but is electrically positive rather than negative. The positron's existence was predicted in theory a few years before it was actually detected. It is not stable in matter since it reacts readily with an electron to give two *gamma rays*.

PROTON One of the basic particles of the atomic *nucleus* (the other is the *neutron*). Its *charge* is equal to that of the *electron* but positive. The simplest atomic species is an *isotope* of hydrogen whose nucleus contains only one *proton*. See *Deuterium*.

RABBIT A capsule which rapidly carries samples in and out of an atomic *reactor* or *accelerator* through a pneumatic or hydraulic tube. Purpose is to permit study of the immediate effect of intense *radiation* upon various materials.

RAD The standard unit of *radiation* dose. The Atomic Energy Control Board has established conservative limits of permissible dose for the protection of atomic workers.

RADIATION The emission of swiftly moving particles and *photons* by *radioactive nuclei* and also the emission of photons by

stable substances when they are struck by high energy *electrons*. *Alpha* and *beta* particles are emitted by *radioactive nuclides* and the photon radiation they emit is called *gamma radiation*. The photon radiation resulting from electron bombardment is called *X-radiation*.

RADIOACTIVE The property of an *isotope* or *element* which is characterized by spontaneous emission of *radiation*.

RADIOCHEMISTRY That phase of chemistry concerned with the properties and behaviour of *radioactive* materials.

RADIOISOTOPE A *radioactive isotope* of an *element*. A radioisotope can be produced by placing material in a nuclear *reactor* and bombarding it with *neutrons*. Many of the *fission products* are radioisotopes. Radioisotopes are sometimes used as *tracers*, as energy sources for chemical processing and as *radiation* sources for food pasteurization and medical treatment. Radioisotopes are at present the most widely used outgrowth of atomic research and are one of the most important peacetime contributions of *atomic energy*.

RADIOISOTOPE THERMOELECTRIC GENERATOR A device in which the energy emitted by *decay* of a *radioisotope* is converted first to heat and then directly to electricity.

RADIOTHERAPY The use of *radiation* to treat diseases.

RADIUM One of the earliest known naturally *radioactive elements*. It is far more radioactive than *uranium* and is found in the same ores.

REACTOR A nuclear reactor is an "atomic furnace". In a reactor, *nuclei* of the *fuel* are burned (i.e., undergo controlled *fission*) under the influence of *neutrons*, in a *chain reaction*. This energy is removed as heat which may be used to make steam for driving steam engines and to produce electricity. The *moderator* for the first reactor was piled-up blocks of graphite. Thus, a nuclear reactor was formerly referred to as a pile. Reactors are usually classified now as research, test, process heat and power, depending on their principal function. No workable design for a controlled *fusion* reactor has yet been devised.

ROENTGEN The standard unit of *radiation* exposure. The Atomic Energy Control Board has established conservative limits of exposure for the protection of atomic workers.

SHIELD (Shielding). A wall or other layer of dense material which protects workers from harmful *radiations* released by *radioactive* materials.

SHUTDOWN Action of a *control rod* to stop the *chain reaction* in a *reactor*. In a liquid moderated reactor, shutdown may be accomplished by removal of some of the *moderator*.

SOURCE Any substance which emits *radiation*. Usually refers to a piece of *radioactive* material conveniently packaged for scientific or industrial use.

SPARK CHAMBER Similar in purpose to the *cloud chamber* or *bubble chamber*. It consists of a series of electrically *charged* plates. If a charged particle crosses the chamber, the *ionization* it produces initiates a spark between the plates.



STRONTIUM-90 A *radioactive isotope* of strontium having a *mass number* of 90. An important *fission product* and constituent of *fallout*. It has a *half-life* of 25 years.

SURVEY METER A portable instrument equipped with a direct reading meter used to determine the level of *radiation* in an area.

THERMONUCLEAR REACTION A *fusion* reaction which is produced when the interacting *nuclei* are contained at an extremely high temperature and which releases a large amount of energy. This is believed to be the sun's source of energy.

THORIUM A heavy *element*. When bombarded with *neutrons* thorium changes into *uranium 233* which is *fissionable* and thus a source of *nuclear energy*.

TRACER A *radioisotope* which is mixed in very small proportion with the stable, naturally occurring *isotopes* of the same *element*. The radioisotope enables scientists to trace the material as it undergoes chemical and physical changes. Tracers are being used widely in science, medicine, industry and agriculture today. When *radioactive* phosphorous, for example, is mixed with a chemical fertilizer, the fertilizer can be traced through the plant as it grows. So little of the radioisotope is used that there is no *radiation* effect upon the process or organism involved.

TRITIUM The third and only *radioactive isotope* of hydrogen, whose *nucleus* contains two *neutrons* and one *proton*. It exists in nature through production by cosmic *radiation* and is also produced by neutron *capture* by *deuterium*.



UNSTABLE All *radioactive elements* are unstable since they emit particles and *decay* to form other elements.

URANIUM A heavy metal. The two principal *isotopes* of natural uranium are U-235 and U-238. U-235 has the only readily *fissionable nucleus* which occurs in appreciable quantities in nature, hence its importance as a nuclear *fuel*. Only 1 part in 140 of natural uranium is U-235.

X-RAY Highly penetrating *radiation* similar to *gamma rays*. X-rays do not come from the *nucleus* of an *atom* but from surrounding *electrons*. They are produced by electron bombardment. When these rays pass through an object they give a shadow picture of the denser portions.

"Z" Symbol for *atomic number*. An *element's* atomic number is the same as the number of *protons* found in one of its *nuclei*. All *isotopes* of a given element have the same "Z" number. $Z = 92$ for all *uranium* isotopes.

ZIRCONIUM A metal which has a low *capture cross-section* for *neutrons*. It also has better mechanical and corrosion-resistance properties than aluminum and is therefore a desirable material for structures in a *reactor core*.

TABLE OF ACCELERATORS AND REACTORS

CYCLOTRON A particle *accelerator*. In this atomic "merry-go-round" atomic particles such as *protons* are whirled around in a spiral between the ends of a huge magnet gaining speed with each rotation in preparation for their assault on the target material.

LINEAR ACCELERATOR A machine for speeding up *charged* particles such as *protons* and *electrons*. It differs from other *accelerators* in that the particles move in a straight line at all times instead of in circles or spirals.

VAN DE GRAAFF ACCELERATOR An electrostatic generator — a particle *accelerator*. To obtain the voltage, static electricity is picked up at one end of the machine by a rubber belt and carried to the other end where it is stored.

TANDEM ACCELERATOR An *accelerator* similar to a Van de Graaff accelerator in which the charge of the accelerated *ions* is reversed after one stage of acceleration so that the same voltage is used to accelerate some of the ions to twice the energy obtainable from the first stage.

NRX (National Research Experimental) A high power research reactor using a *heavy water moderator* built at Chalk River in 1947.

WR-1 (Whiteshell Reactor No. 1) A high power (40MW) research reactor under construction in 1965 at the Whiteshell Nuclear Research Establishment, Pinawa, Manitoba. It uses *enriched uranium oxide fuel*, a *heavy water moderator* and an *organic liquid coolant*.

NPD (Nuclear Power Demonstration) The first Canadian power reactor for the production of electricity. It produces 20 MW of electrical power and uses natural *uranium oxide fuel* and a *heavy water moderator* and *coolant*.

CANDU (Canadian-Deuterium-Uranium) A high power (200 MW electricity) reactor which uses natural *uranium oxide fuel* and a *heavy water moderator* and *coolant* under construction in 1965 at Douglas Point, Ontario.

SWIMMING POOL REACTOR A light water moderated, *enriched uranium* fuelled reactor which is mounted in a large water tank resembling a swimming pool. The water provides the *shielding* and at the same time leaves the *core* easily visible so that experiments on the core may be easily managed. A low power reactor (100 W) of this type has been built at Chalk River and another operating at 1 MW is in operation at McMaster University.

TABLE OF PREFIXES AND UNITS

Factor	Abbreviation
Nano — 1/1,000,000,000	n
Micro — 1/1,000,000	μ
Milli — 1/1,000	m
Kilo — 1,000	K
Mega — 1,000,000	M
Giga — 1,000,000,000	G
Billion — 1,000,000,000	B

These prefixes are applied to the units of measurement in common use.

Nanosecond	— nS
Kilovolts	— kV
Giga electron volts	— GeV
Megawatts	— MW
Milliroentgens	— mR
Microcuries	— μ Ci

COVER PHOTO:

Cerenkov radiation emitted by Cobalt-60 in fuel rods suspended in water filled storage bay, Chalk River Nuclear laboratories.

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